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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/055,270	01/22/2002	Jae-Hyun Joo	9898-217	6757

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EXAMINER

MAI, ANH D

ART UNIT	PAPER NUMBER
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2814

DATE MAILED: 11/08/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/055,270

Applicant(s)

JOO ET AL.

Examiner

Anh D. Mai

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 August 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4,6-15,17-21 and 23-32 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4,6-15,17-21 and 23-32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

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DETAILED ACTION

Amendment

1. Amendment filed August 16, 2002 has been entered as Paper No. 4. Claims 5, 16 and 22 have been canceled. Claims 1-3, 6-11, 13, 14, 17-21, 23 and 24 have been amended. Claims 30-32 have been added. Claims 1-4, 6-15, 17-21 and 23-32 are pending.

Response to Amendment

2. The amendment filed August 16, 2002 is objected to under 35 U.S.C. 132 because it introduces new matter into the disclosure. 35 U.S.C. 132 states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: "the pre-annealing is performed at a range of between 350 ~ 499 °C".

Applicant is required to cancel the new matter in the reply to this Office Action.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 8 and 31 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

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There does not appear to be a written description of the claim limitation “the pre-annealing is performed at a range of between 350 ~ 499 °C” in the application as filed.

At best, the specification discloses a temperature range of 350 ~ 750 °C only (See page 4, line 1 and page 6, line 33). The temperature range of “350 ~ 499 °C” does not have support from the originally filed application.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1-4, 6-16, 17-21 and 23-32 are rejected under 35 U.S.C. 112, second paragraph, as failing to set forth the subject matter which applicant(s) regard as their invention. Evidence that the claims fail(s) to correspond in scope with that which applicant(s) regard as the invention can be found in specification filed January 22, 2002. In that paper, applicant has stated “the crystallization annealing is performed preferably at about **650 °C**”. (see page 7, lines 15-16). The specification also disclosed, and claimed: “the pre-annealing step is preferably performed at a **higher temperature** than the temperature of the crystallization annealing step”. (See page 7, lines 5-7), and this statement indicates that the invention is different from what is defined in the claim(s) because the new matter added include: “the pre-annealing is performed at a range of between **350 ~ 499 °C**”.

By the virtual of the amendment, the new matter: the pre-annealing (**350 ~ 499 °C**) step is performed at a **lower temperature** than the temperature of the crystallization annealing (650 °C) step not at a *higher temperature as the invention had intended and disclosed*.

Claim Rejections - 35 USC § 102

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

5. Claims 1-3, 6, 8-15, 17, 19-23 and 27 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Agarwal et al. (U.S. Pub No. 2002/0037630) (cited previously).

With respect to claim 1, Agarwal teaches a method of fabricating a semiconductor device as claimed including:

forming a lower electrode (12) on a substrate (10);

subjecting the lower electrode (12) to a pre-annealing, wherein the pre-annealing is a thermal annealing under a selected atmosphere;

forming a capacitor dielectric layer (28) on the pre-annealed lower electrode (12), wherein the capacitor dielectric layer (28) is formed of a crystallized material; and

forming an upper electrode (30) on the capacitor dielectric layer (28). (See Figs. 1-7).

Regarding the crystallized material, annealing the dielectric layer (28) is inherently crystallized the dielectric layer.

With respect to claim 2, the lower electrode (12) of Agarwal is formed of a material selected from the group consisting of a metal and a metal oxide.

With respect to claim 3, the lower electrode (12) of Agarwal is formed by a CVD method.

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With respect to claim 13, Agarwal teaches a method of fabricating a semiconductor device as claimed including:

forming a lower electrode (12) on a substrate (10);

subjecting the lower electrode (12) to a pre-annealing, wherein the pre-annealing is a thermal annealing under a plasma atmosphere;

forming a capacitor dielectric layer (28) on the pre-annealed lower electrode (12), wherein the capacitor dielectric layer (28) is formed of a crystallized material; and

forming an upper electrode (30) on the capacitor dielectric layer (28). (See Figs. 1-7).

Regarding the crystallized material, similar reason as, claim 1, above also applied here.

With respect to claim 14, the lower electrode (12) of Agarwal is formed of a material selected from the group consisting of a metal and a metal oxide, and the lower electrode (12) is formed by a CVD method.

With respect to claim 20, Agarwal teaches a method of fabricating a semiconductor device as claimed including:

forming a lower electrode (12) on a substrate (10), wherein the lower electrode is formed by a CVD method, and wherein the lower electrode (12) is formed by a material selected from the group consisting of a metal and a metal oxide;

subjecting the lower electrode (12) to a pre-annealing;

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forming a capacitor dielectric layer (28) on the pre-annealed lower electrode (12), wherein the capacitor dielectric layer (28) is formed of a crystallized material; and forming an upper electrode (30) on the capacitor dielectric layer (28). (See Figs. 1-7).

Regarding the crystallized material, similar reason as, claim 1, above also applied here.

With respect to claim 21, the pre-annealing of Agarwal is one selected from the group consisting of a thermal annealing under a selected atmosphere and a treatment exposing the lower electrode under a plasma atmosphere.

With respect to claim 23, the pre-annealing of Agarwal does not substantially change the materiality of the lower electrode (12).

With respect to claim 27, the selected atmosphere of Agarwal comprises a gas and at a temperature that includes the claimed range.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

6. Claims 4, 6, 8-12, 15, 17, 19 and 30-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Agarwal '630 as applied to claims 3 and 14 above, and further in view of Applicant's admitted prior art.

With respect to claims 4 and 15, Agarwal teaches forming lower electrode (12) on the substrate (10) by a CVD method.

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Thus, Agarwal is shown to teach all the features of the claim with the exception of explicitly using a metal organic material as a source (MOCVD).

However, the admitted prior art teaches that it is conventional in the art to form a lower electrode using MOCVD. (See page 2, lines 13-16).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the lower electrode (12) of Agarwal using MOCVD as taught by the admitted prior art because the layer formed is more conformable to step differences of the underlayer.

With respect to claims 6 and 17, the pre-annealing of Agarwal does not substantially change the materiality of the lower electrode (12).

With respect to claims 8 and 31, as best understood by the examiner, the pre-annealing of Agarwal is performed at a temperature that overlaps the disclosed range.

With respect to claims 9 and 19, the selected atmosphere or plasma atmosphere of Agarwal comprises hydrogen gas.

With respect to claim 10, the selected atmosphere of Agarwal comprises nitrogen gas.

With respect to claims 11 and 12, the selected atmosphere of Agarwal is a mixed atmosphere comprises hydrogen and nitrogen.

With respect to claims 30 and 32, Agarwal teaches subjecting the metal lower electrode (12) to a pre-annealing in selected atmosphere comprises hydrogen gas (reducing ambient) at a temperature that higher than the claimed range. The claimed temperature range does not appear to be critical.

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However, Agarwal also teaches that the temperature required for the pre-annealing process may be reduced if reducing ambient is used.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to reduce the pre-annealing temperature of Agarwal since the reducing ambient is used.

Further, within purview of one having ordinary skill in the art at the time of invention, it would have been obvious to determine the optimum pre-annealing temperature in reducing ambient to treat the lower electrode. See *In re Aller, Lacey and Hall* (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation".

7. Claims 7, 18, 24 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Agarwal '630 as applied to claims 4, 15 and 21 above, and further in view of Aoki et al. (U.S. Patent No. 6,303,952).

With respect to claims 7, 18 and 24, as best understood by the examiner, Agarwal forming a capacitor dielectric layer (28) including:

forming a capacitor dielectric layer (28) on the pre-annealed lower electrode (12); and
subjecting the capacitor dielectric layer (28) to an annealing.

Regarding the crystallization annealing, similar reason as, claim 1, above also applied here.

Thus, Agarwal is shown to teach all the features of the claim with the exception of explicitly disclosing the temperature of the anneal.

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However, Aoki teaches the capacitor dielectric layer (20/324) is subjected to a well known crystallizing temperature following the deposition.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to crystallize the capacitor dielectric layer (28) of Agarwal under a crystallizing temperature as taught by Aoki to reduce leakage currents.

Further, the pre-annealing temperature of Agarwal is performed at up to 900 °C, thus higher than that of the crystallization annealing.

With respect to claim 25, the crystallization temperature of Aoki is similar to that of the claim.

8. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Agarwal '630.

Agarwal teaches subjecting the metal lower electrode (12) to a pre-annealing in selected atmosphere comprises hydrogen gas (reducing ambient) at a temperature that higher than the claimed range. The claimed temperature range does not appear to be critical.

However, Agarwal also teaches that the temperature required for the pre-annealing process may be reduced if reducing ambient is used.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to reduce the pre-annealing temperature of Agarwal since the reducing ambient is used.

Further, within purview of one having ordinary skill in the art at the time of invention, it would have been obvious to determine the optimum pre-annealing temperature in reducing

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ambient to treat the lower electrode. See *In re Aller*, Lacey and Hall (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation".

9. Claims 28 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Agarwal '630 as applied to claim 21 above, and further in view of Narwanka et al. (U.S. Patent No. 6,204,203) (cited previously).

Agarwal teaches subjecting the metal lower electrode (12) to a pre-annealing temperature in selected atmosphere comprises a nitrogen and hydrogen mixed atmosphere.

Thus, Agarwal is shown to teach all the features of the claim with the exception of explicitly disclosing the ratio of the gases used.

However, Narwanka teaches that a forming gas mixture of H_2/N_2 having a ratio of 1-10% by volume are well known in the art to be used to thermally treat the lower electrode.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to perform the pre-anneal treatment of the lower electrode (12) of Agarwal using the forming gas ratio as taught by Narwanka to passivate the lower electrode.

With respect to claim 29, a reason similar to that of claim 26 also applied here.

Response to Arguments

10. Applicant's arguments filed August 16, 2002 have been fully considered but they are not persuasive.

Applicant argues that: "Applicant can find no such specific recitation or suggestion within the reference regarding the use of a crystallized dielectric".

Example, Agarwal teaches: "The metastable compound (lower electrode) may be preferentially oxidized during deposition of dielectric materials such as Ta₂O₅ and subsequent annealing process" (see [0055]) and further "After the dielectric layer and the electrode layers are formed, the capacitor is annealed as described above" (See [0057]).

This teaching is similar to an embodiment of the invention: "a crystallization annealing step may be performed after forming the upper electrode" (See page 7, line 28-30).

It is well known in the art that annealing the capacitor dielectric layer following its deposition, is inherently resulted in crystallizing it. (See Narwanka '203, col. 5-, line 61 to col. 7, line 8 and Applicant's admitted prior art, pages 1-3).

Regarding the amended temperature, the newly added temperature range (350 ~ 499 °C) is new matter and can not find support in the originally filed application.

11. Applicant's arguments with respect to claims 7, 8, 24-26, 28 and 29 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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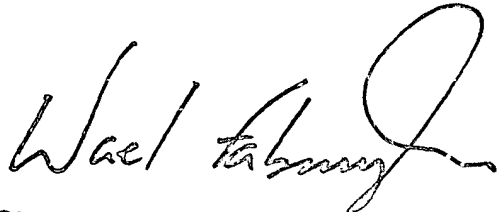
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (703) 305-0575. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

A.M
November 5, 2002


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